TERRORISM, TECHNOLOGY, GEOGRAPHY, AND NORTH AMERICAN SECURITY

George Lindsey

For well over a century, ending with the beginning of the Cold War, geography and the US and Royal Navies protected the mainland of North America from the threat of attack from abroad. The armed forces of the United States and Canada were used to fight on battlefields far from North America.

The Cold War and NORAD

The Cold war brought long-range bomber aircraft, then ICBMs and SLBMs, able to attack North America from other continents with nuclear weapons.

The three-dimensional geometry of the spherical earth ensured that bombers and ICBMs launched from the USSR towards targets in the central forty-eight states of the USA would pass over the Arctic ice, or the waters of the North Atlantic or Pacific Oceans bordering on Canada, and then most of them over the Canadian land mass. The technology of the 1950s limited the detection of bombers and missiles to the lines of sight of radars based on the surface of the spherical earth.

The first requirement was for the earliest possible warning of attack. Against bombers this was provided by the construction

of the Distant Early Warning (DEW) Line of ground-based radars, extending from Alaska, across the northern limit of the Canadian mainland, across Greenland and Iceland to the United Kingdom. With bombers approaching at subsonic speeds, this would provide several hours of warning for the US Strategic Air Command (SAC) to get its bombers off the ground for a retaliatory attack, for which the aircraft would be refuelled by tankers based in Canada.

It was also possible to provide active defence against bomber attack, although the effective ranges to which antiaircraft missiles and interceptor fighters could reach were very short compared to the dimensions of North America, so that it would be necessary to deploy many fighter bases and radar stations if large areas were to be defended. An extensive system of airfields, surface-to-air missile sites, and radar stations was deployed across Southern Canada (the “Pinetree Line”) and throughout the United States, supplemented by US Navy picket ships off the American coasts. The Mid-Canada Line of unmanned radars, able to detect bombers flying at extremely low altitude, was installed across the gap between the DEW Line and the Pinetree Line. The operations were integrated into the North American Air Defence System (NORAD), manned by the armed forces of both the US and Canada. Additions to the assets deployed in

Canada later on in the Cold War included nuclear armed Bomarc Surface-to-Air Missiles, Genie nuclear Air-to-Air Missiles for the CF101 fighters, and Airborne Warning and Control (AWACS) aircraft which could control interceptions over areas beyond the range of the ground-based radar system.

As the Cold War proceeded, the threat of ICBMs and SLBMs overtook that from bombers. Early warning of attack was even more urgent, but technology and geometry came to the rescue. Infrared sensors mounted in earth satellites in geostationary orbits could observe continuously a large portion of the entire earth, and detect the great heat emitted by the exhausts of the missiles' launching rockets. Powerful radars (BMEWS) situated on the ground in Alaska, Greenland, and Britain were able to track the missiles throughout a portion of their long trajectory far above the earth. SAC could expect half an hour of warning before their bases were hit, and American ICBMs propelled by solid-fuel rockets could be launched with very short notice. SAC could also increase their capability for quick response by maintaining a few bombers on airborne alert, making use of airborne refuelling, for which bases in Canada were useful.

Against Submarine-Launched Ballistic Missiles there was the possibility of tracking the submarines, and attacking them before they could launch all of their missiles. The routes taken by the Soviet SSBNs of the Northern Fleet to reach and patrol off the Atlantic coast of North America took them through waters

neighbouring Canada. The Canadian navy, which had acquired extensive experience in antisubmarine warfare in the North Atlantic during World War II, and played a significant role in the development of antisubmarine helicopters and air-dropped sonobuoys, was heavily engaged in monitoring the activities of the Soviet
submarines.

However, in contrast to the extensive resources that had been deployed to provide active defence against air attack, no comparable countermeasures were put in place for the interception of ballistic missiles in flight. The US pursued several ambitious R&D programs (Sentinel, Safeguard, SDI, GPALS), but only deployed one operational battery (of Safeguard, in North Dakota), for a few weeks in 1975. No plan was ever arranged for deployment of any of these proposed ABM elements in Canada.

NORAD’s responsibilities were extended beyond air defence to include the monitoring of space, and it was renamed “North American Aerospace Defence Command”.

The Role of the Armed Forces Against Terrorism in North America

The new requirement for protection against terrorist attacks in North America presents a question as to what part should be played by the U.S. and Canadian armed forces. For many decades they have been organized, trained, and equipped to fight

in far distant places, against the armed forces of established countries. Then in the Cold War they became responsible for defence of the homeland against attacks launched from intercontinental ranges, again by established countries. But the new threat features attacks launched from inside North America by terrorists that do not represent any established country. However, one of the necessary countermeasures requires operations overseas against terrorists resident in established countries, which may or may not be providing them with surreptitious governmental assistance.

This brief paper cannot cover the many complications implicit in the radical expansion of the problems of defence of North America against terrorism, or even of all of the implications for the armed forces. Instead, it will concentrate on the question of what are the roles that would be most appropriate for the Canadian Armed Forces to undertake in support of defence of North America against terrorism. The experience in NORAD, especially as regards air defence, has demonstrated that there are circumstances, largely determined by technology, geography, and geometry, in which the deployments and operations of the armed forces of the two countries should be completely integrated. But there are other aspects of homeland defence which are better handled on a national basis. Technology and geography are dominant factors in determining what would be best for North America.

Preventing Entry into the Continent

by Terrorists or their Equipment

Most of the terrorists now resident inside North America are immigrants who entered through airports and seaports, and passed the inspection procedures of Canadian or American Customs and Immigration. However, “people smugglers” have arranged for clandestine entries into major ports of persons concealed in container ships or other freighters. The facilities for examination of cargo entering major North American seaports are inadequate for reliable detection of illegal materials.

Responsibility for adequate inspection and admission of people and goods at the legal points of entry rests with the organizations for customs and immigration. And they are dependent on the provision of documentation prepared in other countries, some with the participation of the Canadian or US embassies. Background information regarding persons or materials for which entry is sought may be obtained with the assistance of their country, or by whatever information may be provided by intelligence. These matters are not, however, the responsibilities of the Canadian or American armed forces.

While the major responsibility for management and control of activities on the sea approaches lies with the Coastguard, the facilities possessed by the navy and the air force for surveillance of coastal waters and interception and boarding of ships could be of great assistance, whether for the prevention of transshipments near the coast, the actual discovery of

contraband, or by alerting the shore authorities of suspect features of a ship, her passengers, or her cargo, or of an aircraft.

The Threat of Missiles Launched from Inside North America or its Coastal Waters

Terrorists are unlikely to have the means to acquire long-range bomber aircraft, ICBMs, SLBMs, or ballistic missile firing submarines. They are, however, more likely to be able to procure short-range cruise or ballistic missiles (already widely dispersed in many countries).

They could well be able to acquire nondescript well-used freighter vessels, and refit them to carry and launch surface-to surface missiles able to attack targets on or close to the seacoasts of North America. The launching apparatus could be undetectable by overhead surveillance until shortly before the missiles were launched.

However, instead of launching their attack from offshore, it
will probably be more feasible for terrorists to establish and equip small clandestine cells of dedicated and suitably trained terrorists inside the US and Canada, able to make their preparations covertly, and await the order to attack.

Land-based attacks against stationary targets could be from Short-Range Ballistic Missiles or cruise missiles, with ranges

of no more than a few hundred miles, down to very short-range rocket weapons, mortars, or grenade launchers, able to lob warheads over a few city blocks into a sports stadium or water reservoir.

Another menacing type of land-based attack would be with hand-held (or other light) Surface-to-Air Missiles, launched from sites close to major airports, against large aircraft just beginning their climb following takeoff.

Other Threats Delivered from Inside North America

Operating from inside the continent, the easiest means of delivering a weapon would seem to be by conventional methods of transport, such as trucks, automobiles, and aircraft, obtained by purchase, rental, or theft. Examples have been presented already in Oklahoma, New York, and Washington. Against a ship in port, or moored nearby, a small boat loaded with explosives can deliver serious damage, as was demonstrated by the attack on the US destroyer Cole in Yemen, and could be repeated against an American or Canadian cruise ship in a Caribbean or Central American port.

As has been demonstrated so frequently in Israel and elsewhere, and now in Iraq, if the survival and escape of the perpetrator is not a consideration, and the payload is inconspicuous, personal delivery by a suicide bomber into a group of unsuspecting victims is extremely difficult to deter or

to prevent.

There is, of course, a long history of other tactics for terrorism, such as the methods of sabotage adopted by the underground and Maquis groups of citizens of countries invaded and occupied during World War Two, or by the Viet Cong in South Vietnam. Bombs, grenades, Molotov cocktails, and booby traps can be very effective. Bridges and tunnels are both vulnerable and essential for efficient transportation. Subways are attractive targets because of the concentration of victims in places with limited ventilation. The occupants of large buildings can be attacked through its ventilation system.

New forms of disrupting society are likely to arise by exploitation of recently developed technologies, such as those depending on computer networks. A probable foretaste is the activities of computer hackers.

Most of the defences against these types of threats (which are probably the most likely) would seem to fall within the responsibilities of civilian rather than military organizations. But some of the training given to military personnel for such purposes as detection of and protection from chemical and biological weapons, decontamination, and first aid for the wounded, can be made available to selected civilian organizations.

The Importance of Wide-Area Surveillance

Terrorists intending to enter the United States or Canada without having to pass inspection by the immigration authorities may choose illegitimate entry in light aircraft, taking off from Central America or the Caribbean, and landing on fields or lakes rather than airports designated and equipped to accept foreign arrivals. Or they could cross the Atlantic or Pacific on a freighter, perhaps bringing essential equipment with them, and choose between transferring to a small fast boat for a run ashore to a dock controlled by colleagues, or hide on the ship after she anchors at a major port, and attempt to sneak ashore without detection.

Defence against these forms of illegal entry will require surveillance of the movement of aircraft and ships approaching Canadian and American shores, including their identification, subsequent movement of aircraft until they land, behaviour of ships in the vicinity of the coast, and the bringing ashore of people and cargo.

Defence against the threat of the launching of missiles from a freighter some distance off shore calls for surveillance of shipping in coastal waters plus the ability to detect and track the launching of missiles and then to intercept them in flight.

Prevention of the launching of missiles from inside Canada or the United States calls for surveillance of activities on land (including ice and snow) rather than water, plus the

ability to detect and track the launching of missiles and then to intercept them in flight.

Prevention of the detonation of a powerful explosion (whether nuclear or conventional HE) or release of CBW material by a ship in or near port would require careful on-board inspection, perhaps cued by previous warnings from intelligence, before the ship has come close to shore.

A crucial form of defence against terrorists already estabished inside North America is to be able to detect their presence and neutralize them before they deliver their attack. If they elect to hide in cities or other fairly built-up areas, they may be discovered by the vigilance of the police or observant citizens. But they may choose to make their preparations in places remote from authorities or curious neighbours, especially if they intend to assemble weapons or other equipment. Or, there could be some radical extremist sect with a small community located in a thinly populated area, to whom terrorism had an appeal, and who would shelter and support foreign terrorists.

Most of the population of Canada is concentrated within a narrow ribbon of territory along the border with the United States, leaving all the rest of the second largest country in the world very sparsely inhabited. Central and Northern Canada has its targets of strategic significance, such as hydroelectric generating stations, dams, and oil and gas

pipelines. But it would be an important contribution to the security of the United States as well as of Canada if it were possible to establish surveillance over the sparsely inhabited regions of Canada.

Characteristics of Wide Area Surveillance

Defence against all except the last of these threats demands surveillance over vast areas of the sea, the land, or the air above them. The most effective means of detecting the presence, position, and movement of a ship or an aircraft, or the activities on the ground, is through the use of radar, or of electro-optical means (i.e. ultraviolet, visible, or infrared light). All of these radiations travel in straight lines until they encounter something which reflects, refracts, scatters, or absorbs them. Consequently, because the earth is round, in order to enable a sensor to oversee a large surface of the earth in a short time it is necessary to place it at a high altitude above the surface. This has the disadvantage that the lines of sight from the sensors will have to penetrate most of the layers of the atmosphere, which may contain clouds which will absorb the radiations of the electro-optical sensors. Another disadvantage is that the long range between sensor and target makes it more difficult to obtain high resolution imagery, and requires higher power for the transmitters of active sensor systems.

Altitudes of sensors in use today extend from those of radar antennas mounted the superstructures of ships, a few tens

of metres above sea level, up to the 35,880 km of a satellite in geostationary orbit. In between these wide extremes are ground-based radars with antennas which can be on high towers or sited on mountain tops, tethered balloons, aircraft (manned and unmanned), and satellites orbiting at less than geostationary altitudes.

Radar sensors based on the ground, or on tethered balloons, able to operate at night and through cloud cover, are well suited for the continuous observation of one particular area of the sea or the sky. An electro-optical sensor in geostationary orbit can detect the launching of ballistic missiles over a huge area, and track them from the time that they rise above the clouds until their propulsion rockets burn out.

Sensors on mobile platforms such as aircraft and low-altitude satellites use their mobility to extend their coverage over areas far greater than their instantaneous field of view, but this coverage is necessarily intermittent. A satellite in low earth orbit may be able to revisit a given area for a few minutes, several times a day, but it has very limited ability to alter its schedule.

Aircraft have limited airborne endurance, and the altitudes available to them provide much smaller fields of view. However, their movements are far more flexible, and they can be

revectored to visit, and perhaps remain for a time, in an area of prime interest, or where sunlight and weather conditions afford the best visibility. And they can change their altitude to select the best combination of field of view (enlarged by flying high) with resolution of detail (improved by flying low).

Each type of sensor has its strengths and limitations. Radar can see through clouds and in the dark, but has limitations to its range and cannot resolve the detailed shape of small targets.

When looking down at the surface of the sea, or especially the earth, it faces the problem of distinguishing small targets against the competing background of much stronger returns from the surface. However, it is possible to process the signals so as to distinguish returns from objects which are moving with respect to the surface, and therefore reveal the presence of aircraft in flight, and fast moving ground vehicles.

Passive sensors depending on visible light can deliver excellent resolution, but cannot see through clouds or in the dark. But with infrared radiation they can detect objects in the dark which have temperatures only slightly different from that of their background. Spectral analysis of electro-optical radiations can reveal all sorts of information that is not evident from a black and white or monochrome image.

Fortunately, the remarkable progress in the technology of

remote sensing equipment now allows several types of sensors to be carried in one aircraft or satellite. This improves not only the area that can be covered, but also the amount of information that can be deduced by combining the data from different sensors.

The requirement for continuous surveillance of a large area depends on the nature of the targets which need to be detected and identified. Uninterrupted observation is essential for rapidly moving targets such as missiles or aircraft, but it is not necessary for the accumulation of intelligence regarding activities which are developing gradually in some fixed locality. The movement of ships need not be recorded minute by minute, but intervals of hours may be too long.

The problems of detecting aircraft and missiles in flight depend upon whether they are above or below the observing sensors.

When the sensors are looking downward, the signals which they receive from the body of an aircraft or missile are very weak compared to those from the surface of the earth or the sea, but it may be possible to identify them by the fact that they are moving. But against aircraft or missile targets flying at altitudes well above that of the sensors, detection and tracking can be conducted against the background of empty space,

It is evident the most effective overhead surveillance of large areas of sea, land, and the air above them can be achieved

by employing several types of sensors, using the latest technologies for the processing, combination, transmission, and display of the vast amount of information which is collected. And these sensors will need to be deployed on several types of platforms, probably including tethered balloons and unmanned aerial vehicles as well as satellites and manned aircraft.

Two types of overhead surveillance are needed. One would be nearly continuous cover of the very large area of the North American continent and its approaches, using sensors carried by satellites and high altitude aircraft (manned or unmanned), and consequently not providing high resolution for detail. The other component would be composed of sensors mounted on helicopters, UAVs, or manned aircraft, providing good resolution to enable a more thorough, and perhaps continuous, examination of objects in a limited area.

Summary and Conclusions

Prior to the Cold War, the territory of North America was protected by the vast expanses of the Atlantic, Pacific, and Arctic Oceans and the mastery of the first two by the navies of the United States and Britain. During the first part of the Cold War, this security was threatened by the long-range bomber aircraft of the Soviet Union, especially as they acquired thermonuclear weapons. The three-dimensional geometry of Planet Earth dictated that, whether attacks launched from the USSR were directed against targets in the United States or in Canada, they would fly over Canadian territory, or the portions of the North

Atlantic and North Pacific Oceans close to Canada.

Defence against this new threat called for two reactions: provision of early warning to allow the USAF to get their strategic bombers off the ground, and establishment of active defences to intercept the bombers before they reached their targets. Bases in Canada were made available for refuelling of the bombers, which in the earlier years had limited ranges. For both warning and active defence it was essential to deploy radar stations and bases for interceptor aircraft in Canada.

The resulting air defence system, organized as NORAD, combined the contributions by the United States and Canada of personnel, equipment, and bases so as to exploit the geography of North America and the geometry which determined how the technology of the 1950s and 1960s could function.

As the Cold War wore on, the new threat of ballistic missiles overtook (although did not eliminate) the bomber threat. Early warning of ICBM launching could be obtained by a new type of radar (BMEWS), deployed in Alaska, Greenland, and England, rather than Canada. Major R&D programs were undertaken for active defence against ICBMs, but plans for deployments did not require siting of equipment in Canada. However, for defence against submarine-launched missiles the Canadian navy undertook a significant role in surveillance of the waters in the North Atlantic through which Soviet submarines came for their patrols.

With the end of the Cold War the threat of long-range attack on North America from bombers, ICBMs, and SLBMs was no longer a significant concern. But the present decade has brought the threat of terrorism, controlled by subnational groups scattered throughout the world but not acknowledged by any established state.

Some forms of terrorist attack against North America could be launched from coastal waters, the Caribbean, or Central America. But they are more likely to be projected from inside the continent, by terrorists already resident, who have had time to prepare the attack.

Of the numerous possible countermeasures to terrorist attacks from inside the continent, many fall into the categories of prevention of entry of terrorist personnel and equipment into North America, and surveillance of suspect activities inside the continent. For both of these categories it is important to consider what are the most useful contributions to the defence of North America which could be made by Canada, and in particular by the Canadian armed forces. And to do this, due attention should be given to the significance of geography and geometry, neither of which are going to change, and of technology, which is changing very rapidly.

For prevention of the entry of terrorists into the continent, most of the barriers are the responsibility of

immigration and customs, airport and seaport authorities, and the collectors of intelligence. However, attempts to evade these barriers by illegal entry of aircraft, large ships, or small fast boats can be contested by surveillance of the approaches to the continent, whether by sea or by air. Here, the capabilities of the navies and air forces can be employed, with many opportunities to improve them by application of the latest technologies. Although entry into the United States can come from any direction, many of the likely approaches come into or over Canada, or through Canadian waters. And the Canadian navy and air force have had long experience in and

have pioneered new technologies for surveillance of the North Atlantic Ocean.

For detection of terrorist activity inside North America, much will depend on police and intelligence agencies and on the vigilance of observant citizens. However, Canada has far more than its share of sparsely inhabited regions, and has a number of valuable strategic targets located far from urban areas. Consequently, it would be highly desirable for the security of the continent if effective overhead surveillance of these underpopulated regions were to be established. Somewhat more demanding imagery would be desirable for obtaining information about activities on the ground than on the sea. There would be more opportunity to combine intermittent wide area reconnaissance at high altitude, but with limited resolution, to

indicate targets deserving of more detailed examination, with subsequent lower altitude observation for close inspection.

Overhead surveillance of the northern regions of the North American continent and its oceanic and Arctic approaches appears to be a natural role for the Canadian Air Force and Navy. And it would
also provide a capability which could prove extremely valuable for other missions in support of operations in distant parts of the world, as well as for the homeland defence of the United States and Canada.